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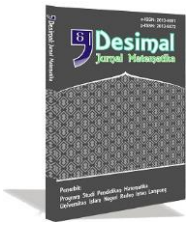

Analysis of the mathematical reflective thinking ability of MTs students in terms of self-regulated learning during the COVID-19 pandemic

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ABSTRACT

This research aims to analyze and describe students' mathematical reflective thinking abilities during online learning in terms of self-regulated learning during the COVID-19 pandemic. The method used is qualitative descriptive. The purposive sampling technique was used to select 3 samples consisting of 1 subject having high self-regulated learning, 1 subject having moderate self-regulated learning, and 1 subject having low self-regulated learning. The instrument in this research used a mathematical reflective thinking ability test and self-regulated learning questionnaires. Data analysis in this research uses the Miles and Huberman model, namely data reduction and categorization, data presentation, drawing conclusion, or verification. The triangulation technique is carried out by comparing the results of the mathematical reflective thinking test with interviews to verify the validity of the data. The conclusion of this research is that subject who have high self-regulated learning is quite reflective, the subject who have moderate self-regulated learning is quite reflective, and the subject who have low self-regulated learning is less reflective.

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INTRODUCTION

The COVID-19 pandemic that has hit all regions of the world has a major impact on all areas of activity. The COVID-19 pandemic has spread from developing countries to developed countries. COVID-19 can affect people of all ages (Turmuzi & Hikmah, 2021). To slow the spread of this virus, the government urges all Indonesians to do social distancing. Almost all economic, social, cultural, and educational activities are reduced or even temporarily suspended for an undetermined time (Kusuma, 2020). The Ministry of Education and Culture of the Republic of Indonesia has issued Notification No. 4 of 2020 concerning the Implementation of Education Policies for the Spread of COVID in Emergency Situations. In a pandemic situation like this, the government implements an

online learning policy (on the network) (Kemendikbud, 2020).

Learning mathematics in schools not only aims to understand the mathematics material being taught, but also trains students to identify, analyze, and predict how to solve problems to the stage of concluding. The ability to think mathematically is one of the benchmarks in achieving the goals of learning mathematics. Especially higher-order thinking skills including the ability to think logically, creatively, critically, problem solving, mathematical connections, mathematical communication and reflective. Among the mathematical abilities above, one of the mathematical abilities that is still very low and less noticed by mathematics teachers in schools is the ability to think mathematically reflective. Based on the results of the research conducted by Nindiasari & Pamungkas (2017) more than 60% of students have not been able to meet all indicators of reflective thinking ability. It shows that students' mathematical reflective thinking abilities are still relatively low (Faradila et al., 2020).

Santrock (2010) argues that thinking is managing and transforming information in memory. Reflective thinking abilities can be useful as a tool/intermediary for students in thinking to solve problems. Thus, the mathematics learning process will be maximized if the students' mathematical reflective thinking abilities are good enough. According to Kurniawati et al. (2019), reflective thinking is one of the higher-order thinking skills in solving a mathematical problem. Mathematical reflective thinking ability is a thinking process that can make students to try to connect the old knowledge they have with the new knowledge they are learning. This is in line with the opinion of Sari et al. (2020) that reflective thinking is part of the higher-order thinking skills that exist in learning mathematics and emphasizes the process by connecting the knowledge that has been owned and being studied in analyzing, evaluating, concluding and deciding the best solution to the problem given. Based on the description above, it can be concluded that mathematical reflective thinking abilities are part of higher-order thinking skills which in the process, it involves old knowledge and new knowledge both in analyzing, evaluating, and concluding a mathematical problem.

Surbeck, Han and Moyer (as cited in Dian et al., 2018) stated that the indicators of reflective thinking involves three levels/phases, namely Reacting (reflective thinking for action), Comparing (reflective thinking for evaluation) and Contemplating (reflective thinking for critical inquiry). Reacting phase refers to the students' ability to mention the information that is known so that it is sufficient to answer what is asked. Comparing refers to the students' ability to relate the problems asked to the problems that have been faced. Meanwhile, the Contemplating phase refers to the students' ability to explain what is being done, detecting and fixing if there are errors in doing the question and draw conclusions correctly.

Online learning requires students to always be creative and be able to organize themselves as good as possible so it makes students to be more independent by utilizing the existing media and applications such as youtube, google classroom, zoom, whatsapp group, and so on so that students are free to access lessons anytime and anywhere. This certainly affects the success of a learning whether it will be better or vice versa. Especially in learning mathematics in solving the problems with higher-level thinking skills, one of which is the ability to think mathematically reflective.

Apart from the ability to think mathematically reflective, the aspect of

learning independence (Self-regulated) of students is also very important and needs to be considered. By having high self-regulated learning, students can control themselves to be better at learning and have high initiative and willingness to learn. As stated by Fida (2020) that self-regulated learning is the ability of someone who has knowledge of effective learning strategies and knows how and when to use that knowledge so that students are able to self-regulate in learning. Sometimes learning independently is difficult due to a lack of confidence in the new knowledge gained, but learning independently needs to be trained to get used to learning something without help from others. This is in line with the opinion of Ratnafuri & Muslihati (2020) that self-regulated learning is an activity where individuals who learn actively as regulators of their own learning cycle process repeatedly, starting from analyzing tasks, choosing, finding strategies, and monitoring the results of strategies in completing academic assignments. The researcher concludes that self-regulated learning is a process of designing and managing effective and efficient learning strategies to the stage of learning evaluation and tasks independently by using the knowledge they have.

The indicators of self-regulated learning according to Subekti & Jazuli (2020), include (1) Initiative, (2) Designing learning needs, (3) Setting goals, (4) Setting strategies, (5) considering difficulties as challenges, (6) find and utilize the learning resources needed, (7) control the process and evaluate learning outcomes, and (8) the ability to self-regulate.

Students' self-regulated learning needs to be developed because student self-regulated learning is something that determines the success of student learning (Ansori et al., 2019). This is supported by the statement of Handayani & Hidayat (2019) which says that the implementation of PJJ (distance learning) will certainly have an impact on student learning outcomes, and this cannot be separated from the students' self-regulated learning. It means that PJJ requires high self-regulated learning from students to be able to understand the material being taught, because self-regulated learning a positive effect on learning outcomes.

Based on research conducted by Suhartina et al. (2019) at SMPN 8 CIMAHI entitled "Analysis of the Reflective Thinking Ability of Junior High School Students in Cimahi City on Algebraic Operational Material Viewed from Self-Regulated" in general, it shows that students' reflective thinking abilities are classified as low, and there is no significant effect between self-regulated learning on the ability to think mathematically reflective. So, it is necessary to give a lot of stimulus questions that contain mathematical reflective thinking skills so that students' mathematical reflective thinking abilities can continue to improve.

Another research was also conducted by Dian et al. (2018) entitled "Analysis of Reflective Thinking Ability in Solving Square Material on Story Questions for 8th Grade Students of SMP Kristen 02 Salatiga Academic Year 2017/2018" shows that the higher the initial mathematical ability of students, the higher their mathematical reflective thinking abilities, and vice versa, the lower the initial mathematical ability of students, the lower their mathematical reflective thinking abilities.

Based on some of the researches above, the results show that students' initial/basic mathematical abilities and self-regulated learning have different effects on mathematical reflective thinking abilities of students. Where self-regulated learning does not significantly affect the reflective thinking ability of students while learning in class. So, in this

research the researchers adopted some of the results of the researches above which were then further developed so that the purpose of this research is to analyze, describe, and find out the differences in mathematical reflective thinking abilities in terms of self-regulated learning of students during online learning during the COVID-19 pandemic with the previous researches when the learning is done face-to-face in the class.

METHOD

The research method used in this research is a qualitative descriptive research. The research was conducted at MTs. Al – Hamid East Jakarta, DKI Jakarta in class VIII of the 2020/2021 academic year via WhatsApp and Google Form because at the time of the research, the COVID-19 pandemic was in progress. Research subjects were determined using a self-regulated learning questionnaire. Self-regulated learning questionnaires are used to categorize students who have high, moderate, and low self-regulated learning. Students work on the questionnaire using a Google Form that has been created by the researcher. The research subjects obtained were 3 students, consisting of 1 subject who had high self-regulated learning, 1 subject who had moderate self-regulated learning, and 1 subject who had low self-regulated learning.

The mathematical reflective thinking ability test (TKBRM) that carried out is a description test consisting of 3 questions about a two-variable linear equation system adapted and modified from Dian et al. (2018). The purpose of this test is to measure the mathematical reflective thinking ability as a research subject. The questions given are in accordance with the indicators of mathematical reflective thinking ability that have been considered previously.

Interviews were conducted using a semi-structured method using a guide in the interview process to dig deeper into the students' mathematical reflective thinking abilities and self-regulated learning, but researchers can also develop questions during interviews with a fixed flow of discussion. Researchers also use documentation as a tool to collect data in the form of student answers and voice records of interviews via WhatsApp.

Data analysis in this research uses the Miles and Huberman model, namely data reduction and categorization, data presentation, drawing conclusion or verification (Sugiyono, 2017). The triangulation technique was carried out to check the credibility of the data, that is by comparing the results of the subject's TKBRM with the interview.

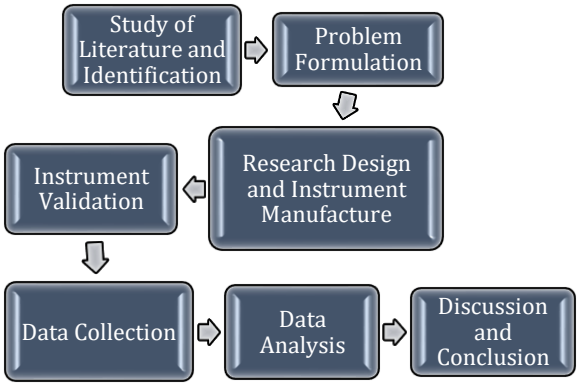

Figure 1. Research Flowchart

RESULTS AND DISCUSSION

TKBRM and self-regulated learning questionnaires were given to 30 students of class VIII-A Mts Al-Hamid Jakarta via Google Form simultaneously. Then the researchers analyzed the scores obtained from each student. Based on the results, the questionnaire produced 3 students with high self-regulated learning, 26 students with moderate self-regulated learning, and 1 person with low self-regulated learning. Then the researcher chose 1 subject with high self-regulated learning (KBT) and high reflective thinking ability, 1 subject with moderate

self-regulated learning (KBS) and high reflective thinking ability, 1 subject with low self-regulated learning (KBR) and low reflective thinking ability as the research subjects as seen in Table 1. The three subjects were selected based on the type of self-regulated learning and the scores obtained from the three subjects were in accordance with the criteria and met the desired sample requirements.

Table 1. The Results of TKBRM and Self-regulated Learning Category

No.	Name	Questionnaire Score	TKBRM Score	Questionnaire Category		
				H	M	L
1	QCA	97	8.66 (Reflective)	√		
2	SZA	75	8.66 (Reflective)		√	
3	SZD	59	0.66(Less Reflective)			√

Remarks = H: High, M: Moderate, L: Low

In question TKBRM number 1, there are students who can answer the question almost completely fulfill all TKBRM indicators.

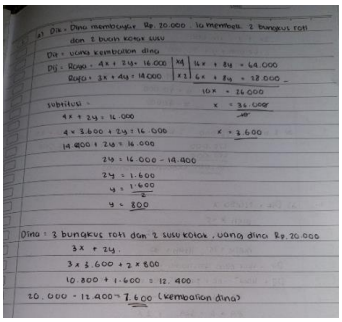

Figure 2. The TKBRM Result of QCA Subject with KBT Number 1

In Figure 2, it can be seen that the QCA subject with KBT has met the Reaction indicator where the subject is able to explain the information that is known and asked in the question, then on the Comparing indicator the subject can relate the problem asked, and on the Contemplating indicator the subject can give conclusions properly and correctly. Then the researchers conducted interviews to strengthen the Contemplating indicator where students were able or not to detect errors and evaluate the answers that had been done. As well as knowing the effectiveness of learning mathematics online. The following is a snippet of the QCA – KBT interview for question number 1.

Q : Do you feel that the question number 1 you are working on was correct?
A : Yes, I'm sure, it's correct.
Q : Do you feel that online learning affects your math scores?
A : I don't think so, because when I compare with the previous score, my math score remains stable.

Based on the interview snippet above, the QCA subject was able to detect the correctness of the answers that had been done so there was no need for further evaluation of the subject's answers. On the next question, the QCA subject felt that learning mathematics online do not affect the results of learning mathematics. Furthermore, the result of TKBRM number 1 from SZ-KBS subject is presented in Figure 3.

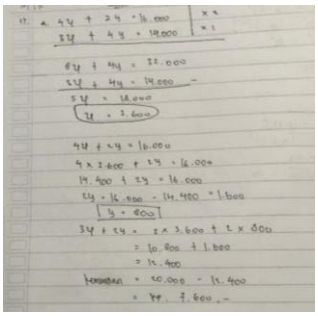

Figure 3. The TKBRM Result of SZ Subject with KBS Number 1

In Figure 3 it can be seen that the subject of SZ with KBS has not met the Reaction indicator where the subject has not been able to explain the information that is known and asked in the question, then on the Comparing indicator the

subject is able to relate the problem asked, and on the Contemplating indicator the subject can provide conclusions properly and correctly but not complete. Then the researcher conducted an interview on the SZ-KBS subject. Here is a snippet of the SZ-KBS interview for question number 1.

Q : Do you feel that the question number 1 you are working on was correct?
A : I'm sure it's true ma'am, but I have doubts that the process is wrong.
Q : Where do you feel that your answer process is wrong?
A : I don't know ma'am, but I think I forgot to explain what is known and what is being asked about the question, ma'am.
Q : Ok, the next question. Do you feel that online learning affects your math scores? If yes, include your reasons?
A : Yes, because online learning makes it easier for me to explore the material on google and have a lot of time to study, while at the dorm I don't have much time to study and explore mathematics learning due to many religious activities.

Based on the interview snippet above, the subject of SZ was able to detect errors in the answers that had been done so that the subject of SZ evaluated the errors and corrected them by adding information that was known and asked. Then the subject of SZ revealed that learning mathematics online affects mathematics learning outcomes, where the subject of SZ's mathematics learning outcomes are higher when online learning than face-to-face learning. Furthermore, the result of TKBRM number 1 from SZD subject is presented in Figure 4.

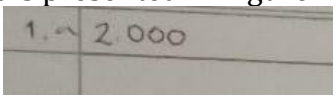

Figure 4. The TKBRM Result of SZD Subject with KBR Number 1

In Figure 4, it can be seen that the subject of SZD with KBR does not meet the Reaction indicator because the subject is unable to explain the information that is known and what is being asked in the question, then on the Comparing indicator the subject is also unable to relate the problem asked, and on the Contemplating indicator the subject cannot give the conclusion at all. Then the researcher conducted an interview on the SZD-KBR subject. The following is a snippet of the SZD-KBR interview for question number 1.

Q : Do you feel that the question number 1 you are working on was correct?
A : No, ma'am, because I don't understand.
Q : Do you find it difficult to do it?
A : Yes, ma'am.
Q : Do you know where you went wrong?
A : No, ma'am, because I forgot how to do the question like that .
Q : Ok, the next question. Do you feel that online learning affects your math scores? If yes, include your reasons?
A : I don't know, ma'am. I don't think so, but I prefer online learning because it makes it easier for me to find similar material on the internet when I don't understand.

Based on the interview snippet above, the subject of SZD was unable to detect the answer errors that had been done so that the subject of SZD could not evaluate and correct the error. Then the subject of SZD revealed that learning mathematics online slightly affects mathematics learning outcomes, where the subject of SZD's mathematics learning outcomes are better when online learning rather than face-to-face learning. Furthermore, the result of TKBRM number 2 from the QCA - KBT subject is shown in Figure 5.

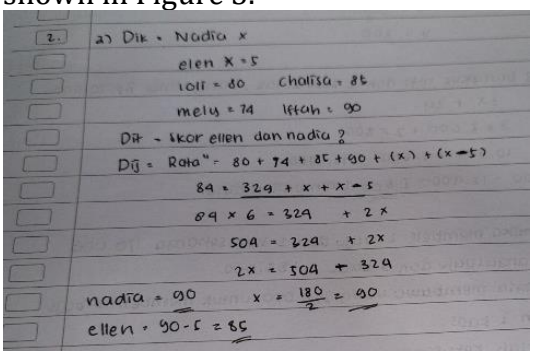

Figure 5. The TKBRM Result of QCA Subject with KBT Number 2

In Figure 5 it can be seen that the subject of QCA with KBT has met the Reaction indicator where the subject is able to explain the information that is known and asked in the question, then on the Comparing indicator the subject can relate the problem being asked, and on the Contemplating indicator the subject can give conclusions properly and correctly. Then the researchers conducted an interview. The following is a snippet of the QCA – KBT interview for question number 2.

Q : Do you find it difficult to do question number 2?
A : Yes, ma'am. I find it difficult to relate what is already known to determine the value of x.
Q : However your answer is correct, how can you do it when you are having trouble?
A : I kept trying many times to find the way ma'am and finally I got it .
Q : How do you conclude a result?
A : Usually I see what is asked first, ma'am, after knowing what is being asked and getting the result, all I have to do is arrange the sentences, ma'am.

Based on the interview snippet above, the subject of QCA-KBT was able to relate the problem with what was asked, even though at first he found it difficult, then the subject was also able to explain how he could write the conclusions properly and correctly. Furthermore, the result of TKBRM number 2 from SZ-KBS subject is presented in Figure 6.

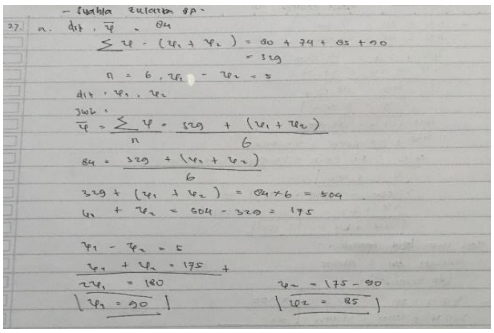

Figure 6. The Result of TKBRM for SZ Subject with KBS Number 2

In Figure 6, it can be seen that the subject of SZ with KBS has met the Reaction indicator where the subject is able to explain the information that is known and asked in the question but it is still incomplete, then on the Comparing indicator the subject can relate the problem asked, and on the Contemplating indicator the subject cannot give conclusions correctly. Then the researchers conducted an interview. The following is a snippet of the SZ – KBS interview for question number 2.

Q : Do you know the information that needs to be written down before compiling an answer?
A : First arrange what is known and what is asked, ma'am.
Q : Do you think the information that you wrote is correct?
A : Hmm, that's true ma'am, but I immediately assumed with x1 and x2, it was not explained ma'am.
Q : Why do not you give a conclusion on question number 2?
A : I think it's correct if I've found the answer to the 2 variables so there's no need to rewrite it and draw up the conclusion.

Based on interview snippet above, the subject of SZ-KBS was less able to write down information in the question properly, correctly and completely, but the subject understood what was being asked. Then the subject has not been able to provide conclusions systematically and completely even though the subject has been able to detect correctness on his answer sheet. Furthermore, the result of TKBRM number 2 from SZD-KBR subject is presented in Figure 7.

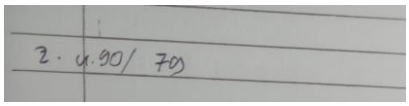

Figure 7. The Result of TKBRM for SZD Subject with KBR Number 2

In Figure 7, it can be seen that the subject of SZD with KBR did not meet all the indicators of mathematical reflective

thinking ability, the subject only wrote the final result without the problem solving process. Then the researcher conducted an interview. The following is a snippet of the SZD-KBR interview for question number 2.

Q : What information is known in number 2?

A : Loli, Nelly, Chalisa, and Iffah math scores, ma'am.

Q : Then why don't you write it down on the answer sheet?

A : I doubt ma'am, I'm afraid my answer is going wrong.

Based on the interview, it was known that the subject of SZD-KBR could not convey information on the questions properly, correctly and completely, because the subject was not sure of his answer. Furthermore, the result of TKBRM number 3 from QCA-KBT subject is presented in Figure 8.

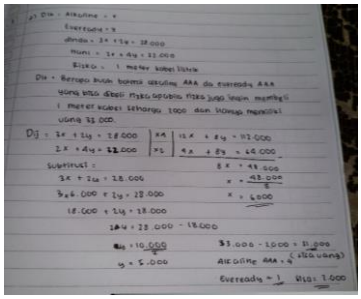

Figure 8. The Result of TKBRM for QCA Subject with KBT Number 3

In Figure 8, it can be seen that the subject of QCA with KBT has fulfilled all the Reaction indicators, on the Comparing indicator the subject can relate the problem asked so as to get the desired result, and on the Contemplating indicator the subject can provide conclusions properly, correctly and completely. Then the researchers conducted an interview. The following is a snippet of the QCA – KBT interview for question number 3.

Q : Is the information you wrote correct?

A : Yes, ma'am, I have written down what is known and asked according to what is in the question.

Q : Do you think that write a complete information in the question is very important?

A : Yes, ma'am, because writing down what is known and asked can make it easier for me to solve math problems, and it's clearer, ma'am.

Q : Wow.. your answer is very good.

A : Thanks, ma'am.

Based on the interview snippet above, the subject of QCA-KBT was able to write down the information that was known and asked completely. The subject also said that writing down the information contained in the story question could make it easier to solve math problems. Furthermore, the result of TKBRM number 3 from SZ-KBS Subject is presented in Figure 9.

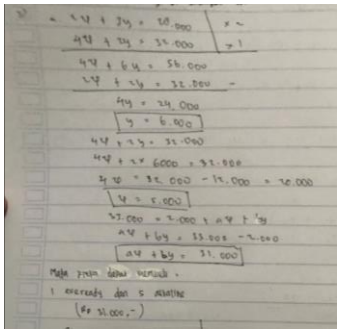

Figure 9. The Result of TKBRM for SZ Subject with KBS Number 3

In Figure 9, it can be seen that the subject of SZ with KBS has not met the Reaction indicator where the subject has not been able to explain the known and asked information in the question, but on the Comparing indicator the subject is able to relate the problem being asked, and on the Contemplating indicator the subject can give conclusions properly and correctly. Then the researcher conducted an interview. The following is a snippet of the SZ-KBS interview for question number 3.

Q : In the previous number, you did not write a conclusion but in number 3 you were able to write a conclusion, how do you write a conclusion?

A : Because in number 3, what is asked was more detailed and had many answers, so I concluded the result that I got, ma'am. Because if I don't conclude I think my answer will be less accurate.
Q : Do you think that write conclusions in the description question is important?
A : I think yes, ma'am, but it is according to the question, whether it is easy to conclude or not.
Q : How do you conclude a result?
A : Usually I see what is asked first, ma'am, after knowing what is being asked and getting the result, all I have to do is arrange the sentences, ma'am.

Based on the interview above, the subject of SZ-KBS was able to write conclusions properly and correctly on the grounds that the question could have many answers so it was necessary to give a conclusion, the subject also said that writing conclusions was important at the final stage of problem solving. Furthermore, the result of TKBRM number 3 from SZD-KBR Subject is presented in Figure 10.

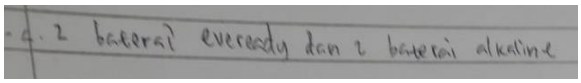

Figure10. The Result of TKBRM for SZD Subject with KBR Number 3

In Figure 10, it can be seen that the subject of SZD with KBR does not meet the Reacting and Comparing indicators, then in the Contemplating indicator the subject is able to write conclusions correctly without the problem solving process. Then the researcher conducted an interview on the subject of SZD-KBR. The following is a snippet of the SZD-KBR interview for question number 3.
Q : How can you conclude the result of question number 3 without a problem solving process?
A : I worked on another sheet, ma'am, what I wrote on the answer sheet was only the final result.
Q : Is question number 3 difficult for you?
A : I think it's pretty good, ma'am, because after I tried many times, the answers could be many, ma'am, so I'm confused which is the correct answer.

Based on the interview above, the subject of SZD-KBR was able to write the conclusion correctly but not quite properly, so that SZD-KBR did not really understand the question given by the researcher because the subject could not write down any information contained in the question.

The results of the 3 research subjects that have been described by the researchers show that the ability to think mathematically reflective varies in each subject which is influenced by self-regulated learning. It confirms that the self-regulated learning of students has increased contribution to the mathematical reflective thinking ability in online learning compared to face-to-face learning as inthe previous research conducted by Nindiasari & Pamungkas (2017) that self-regulated learning does not have a significant effect on mathematical reflective thinking abilities. Which means that in this research the researchers found something new that online learning has a good impact on students, because students can learn and manage their time better at home so that students have plenty of time and learning resources to practice their stimulus skills in learning mathematics material, so that the reflective thinking ability of students improved during online learning during the COVID -19 pandemic.

CONCLUSIONS AND SUGGESTIONS

From the research that has been done, the researcher concludes that students' mathematical reflective thinking abilities improve during online learning during the COVID-19 pandemic if students have high self-regulated learning. The subject who has high self-regulated learning is quite reflective, the subject who have moderate self-regulated

learning is quite reflective, and the subject who have low self-regulated learning is less reflective.

Based on the conclusions above, the authors suggest that further researchers should select the criteria for research subjects to be broader and more specific in analyzing the mathematical reflective thinking abilities and what factors can affect students' mathematical reflective thinking abilities.

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